**KEY CONCEPT**

**Forces change motion.**

**BEFORE, you learned**
- The velocity of an object is its change in position over time
- The acceleration of an object is its change in velocity over time

**NOW, you will learn**
- What a force is
- How unbalanced forces change an object’s motion
- How Newton’s first law allows you to predict motion

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**EXPLORE Changing Motion**

**How can you change an object’s motion?**

**PROCEDURE**

1. Choose an object from the materials list and change its motion in several ways, from
   - not moving to moving
   - moving to not moving
   - moving to moving faster
   - moving to moving in a different direction
2. Describe the actions used to change the motion.
3. Experiment again with another object. First, decide what you will do; then predict how the motion of the object will change.

**WHAT DO YOU THINK?**

In step 3, how were you able to predict the motion of the object?

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**A force is a push or a pull.**

Think about what happens during an exciting moment at the ballpark. The pitcher throws the ball across the plate, and the batter hits it high up into the stands. A fan in the stands catches the home-run ball. In this example, the pitcher sets the ball in motion, the batter changes the direction of the ball’s motion, and the fan stops the ball’s motion. To do so, each must use a force, or a push or a pull.

You use forces all day long to change the motion of objects in your world. You use a force to pick up your backpack, to open or close a car door, and even to move a pencil across your desktop. Any time you change the motion of an object, you use a force.

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**REMINDER**

Motion is a change in position over time.

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**FOCUS**

**Set Learning Goals**

Students will
- Describe forces and how unbalanced forces change an object’s motion.
- Explain how Newton’s first law allows them to predict motion.
- Explain how the inertia of an object affects its motion.
- Design an experiment to investigate inertia.

**3-Minute Warm-Up**

Display Transparency 12 or copy this exercise on the board:

Decide if these statements are true. If they are not true, correct them.

1. Speed includes direction, while velocity does not.
   - **true**
   - **Velocity includes direction, while speed does not.**

2. A moving object covers the same distance in less time if its velocity is greater.
   - **true**
   - **Acceleration measures change in velocity over time.**

3. Acceleration measures only change in speed.

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**MOTIVATE**

**EXPLORE Changing Motion**

**PURPOSE** To introduce the concept that force is needed to change motion

**TIP 10 min.** Have groups compare two or three objects of their choice.

**WHAT DO YOU THINK?** The force and direction with which you push determine the speed and direction of the object’s movement.

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**RESOURCES FOR DIFFERENTIATED INSTRUCTION**

**Below Level**

**UNIT RESOURCE BOOK**
- Reading Study Guide A, pp. 78–79
- Decoding Support, p. 124

**AUDIO CDS**

**Additional INVESTIGATION,**
- Newton’s First Law, A, B, & C, pp. 138–146;
- Teacher Instructions, pp. 346–347

**Advanced**

**UNIT RESOURCE BOOK**
- Challenge and Extension, p. 84

**English Learners**

**UNIT RESOURCE BOOK**
- Spanish Reading Study Guide, pp. 82–83

**AUDIO CDS**
- Audio Readings in Spanish
- Audio Readings (English)